Lighting in Residential Roads: What do we need to perceive?

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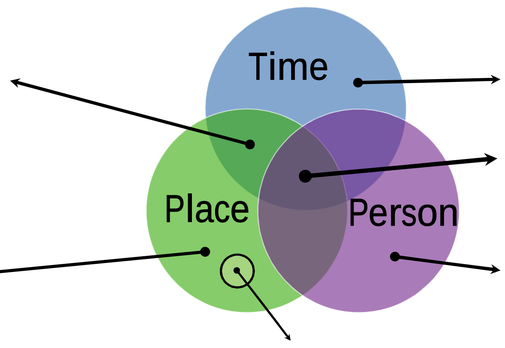
Factors to consider when examining the possible effect of lighting on reassurance in pedestrians:

"Our perceptions, attitudes, actions are formed by a combination of our social & physical environment." (Gifford 2007)
Spaces have social meaning. Fear of Crime has geographical; economic; social; cultural & psychological dimensions. (Pain 2000)



The time of day affects our spatial behaviour (Hanyu 1997).
Negative affect of darkness on affective/emotional appraisals of places (Box et al. 1988.)
Darkness transfers the world into lurk lines (Warr 1985,1990).

Spatial Behaviour

The person we are affects our perceptions.
"The risk of crime is projected into a given environment, elaborated with a face (the potential criminal) and a context (the place it might take place), rooted and situated in the everyday" (cf. Jackson, 2006, 2008)
Therefore our experience of crime may affect how easily we are reassured.
Need to understand social & political identity. (Pain 2000)

The cues that we receive from the environment affect how we feel in it.
- Prospect (open view) -Refuge (protection) theory (Appleton1975)
- 'Concealment' or hiding places(Nasar et al. 1993)
- Signs of deterioration in graffiti and rubbish.
- Hanyu, Johanssen linked visual properties to affective appraisals.

Lighting

Aim: Does Lighting Affect Sense of Security & Fear of Crime?

Environment Features

Table 1. Summary of the methods used in past studies of perceived safety in residential roads. (Unwin & Fotios, 2011)

Study	Independent variables	Outcome: did lighting affect reassurance?
Morante, 2008	Change from HPS to induction and CMH. Street 1: HPS 8.72 lux to Induction 2.69 lux. Street 2: HPS 3.2 lux to 3.10 lux CMH.	Yes. Perceptions of safety and security improved under CMH and induction lighting conditions.
Akashi, Rea and Morante, 2004	Change from HPS to fluorescent lighting: Before, 3.4 lux; after, 2.8 lux.	Yes. Significant increase in feelings of security after change from HPS to fluorescent lighting. (p=<0.01).
Knight, 2010	Change from HPS to CMH and vice versa. Spain: before, SON 82 lux; after CDO 81 lux. vertical illuminance: before and after; 10 lux. Netherlands: before, SON 16.5 lux; after, CDO 14 lux. Vertical illuminance: before, SON 3.3 lux; after CDO 1.4 lux. UK: before, SON 9.1/12.7 lux; after CDO 8.9/12.6 lux. Vertical illuminance: less than 5% difference.	Yes. Higher spatial brightness contributes to higher perception of safety in already safe areas. Yes. Significant increase in feelings of security after change from HPS to fluorescent lighting. (p=<0.01).
Atkins et al, 1991	Unspecified relighting.	Yes for women however no figures to explain statistics.
Herbert and Davidson, 1994	Change from LPS to HPS lamps; change in illuminance unclear.	Trend for an improvement in reassurance but no statistics
Nair et al, 1993	Unspecified improvements to lighting	No
Painter, 1994	Change of lamp type of illuminance. Before, LPS, 3.0 lux; after, HPS, 10.0 lux.	Trend for an improvement in reassurance but no statistics

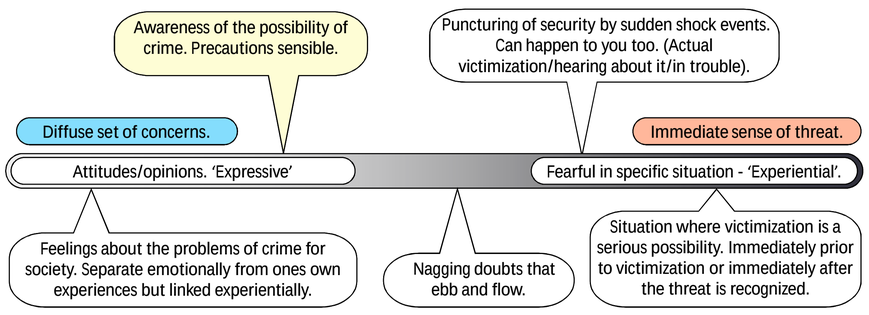


Figure 1. The different definitions of fear (Farrell)

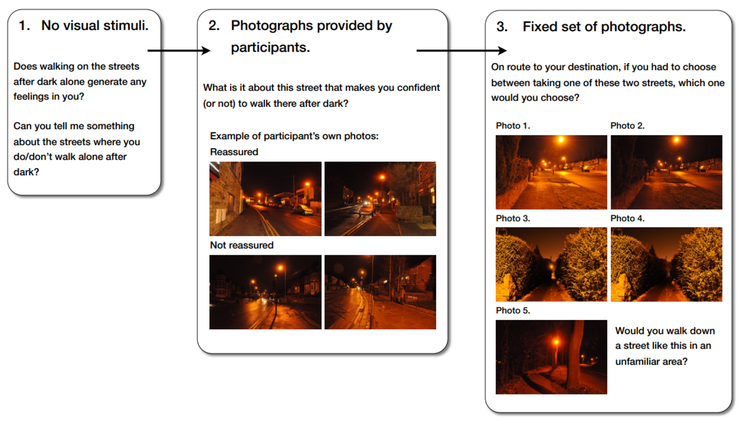
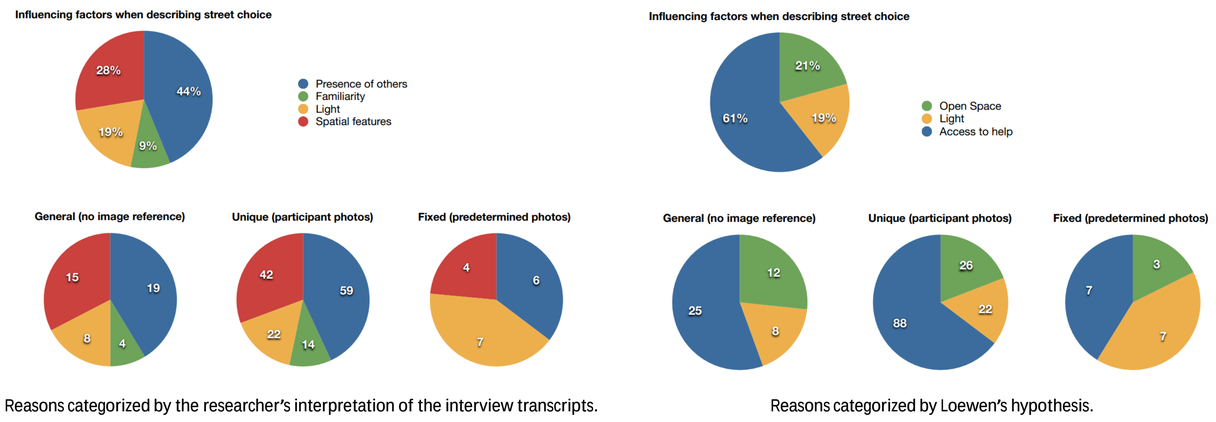


Figure 2. Sequence of actions for Study One - Does light matter?"



Reasons categorized by the researcher's interpretation of the interview transcripts.

Reasons categorized by Loewen's hypothesis.

Interpersonal Judgments

Caminada & van Bommel (1980 &1982):
"In order to provide the visual information needed for personal recognition purposes, for security and for normal social contact, an value of at least 0.8 lux semi-cylindrical illuminance will give a facial recognition distance of approximately 4 m (based on E.T. Hall's definition of 'zones of proximity')"

Minimum: d_{face}=4 m at $E_{semicyl}$=0.8 lux

Recommend: d_{face}=10 m at $E_{semicyl}$=2.7 lux

Basis of Street Lighting Standard
CIE 136-2000 (CIE 92-1992)
CIE 115-2010 (CIE 115-1995)
BS 5489-1:2003
BS EN 13201-2-2003
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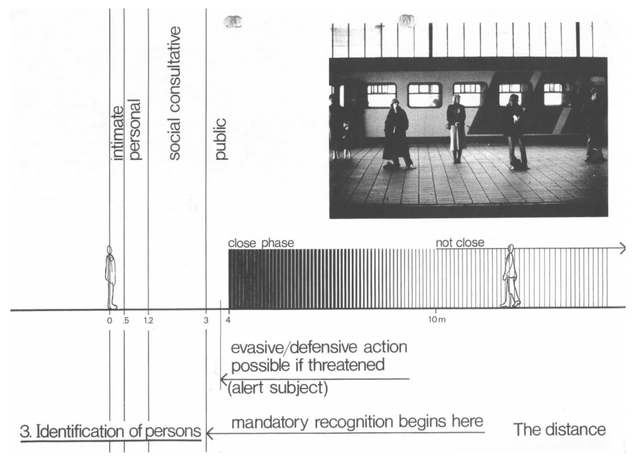

VAN BOMMEL, W. & CAMINADA, E. 1982. Considerations for the lighting of residential areas for non-motorised traffic. *CIBS national lighting conference.*

What Comfort Distance do pedestrians need at night?

Does Facial Recognition matter in judging the intent of approaching people?

1. Both lighting and distance have effect on intimacy personal distance (Carr & Dabbs, 1974). 2. Interpersonal closeness may cause significantly less discomfort under high illumination than it did in dim condition (Adams & Zuckerman, 1991). 3. Minimum comfortable distance did not show a large variation in regard to the lighting level (Fujiyama et al., 2005).	1. What needs to be measured is the extent to which the intent of someone approaching can be accurately recognized, namely, friendly or not rather than strange or not (Fotios & Raynham, 2011). 2. Observers' judging facial expression are strongly influenced by emotional body language (Meeren et al, 2005)

PILOT STUDY: WHAT VISUAL INFORMATION CAN PEDESTRIANS PERCEIVE ON AN APPROACHING PERSON UNDER STREET LIGHTING?

Table 2. Tick-box Sheet for Visual Information obtained by Pedestrians at Different Distances

Features of target	Prompts for experimenter	Practice Target: 0 Distance: 15	Trial 1 Target: Distance:	Trial 2 Target: Distance:	Trial 3 Target: Distance:	Trial 4 Target: Distance:	Features of target
Gender	Male/Female	☐Yes	☐Yes	☐Yes	☐Yes	☐Yes	Gender
Ethnic Group	e.g. Western/Eastern	☐Yes	☐Yes	☐Yes	☐Yes	☐Yes	Skin Colour
Age Group	e.g. Young/Middle/Old	☐Yes	☐Yes	☐Yes	☐Yes	☐Yes	Age Group
Build	e.g. Slim/Well-built/Stout	☐Yes	☐Yes	☐Yes	☐Yes	☐Yes	Build
Cloth Type	Upper Body (e.g. Jacket/shirt/T-shirt/Suit/Sweater) Lower Body (e.g. Jeans/Shorts/Casual)	☐Yes ☐Yes	☐Yes ☐Yes	☐Yes ☐Yes	☐Yes ☐Yes	☐Yes ☐Yes	Cloth Type
Cloth Colour	Upper Body (e.g. Black/White/Blue) Lower Body ()	☐Yes ☐Yes	☐Yes ☐Yes	☐Yes ☐Yes	☐Yes ☐Yes	☐Yes ☐Yes	Cloth Colour
Shoe Type	e.g. Boot/Sport shoes/Sloe	☐Yes	☐Yes	☐Yes	☐Yes	☐Yes	Shoe Type
Shoe Colour	e.g. Black/Brown/Blue/White	☐Yes	☐Yes	☐Yes	☐Yes	☐Yes	Shoe Colour
Hair Length	e.g. Long/Medium/Short	☐Yes	☐Yes	☐Yes	☐Yes	☐Yes	Hair Length
Hair Colour	e.g. Black/Blond/White	☐Yes	☐Yes	☐Yes	☐Yes	☐Yes	Hair Colour
Facial Expression	e.g. Smile/Staring/Angry/Sad/Disgust	☐Yes	☐Yes	☐Yes	☐Yes	☐Yes	Facial Expression
Facial Complexion	e.g. Tanned/Pale/Wrinkled/Freckled	☐Yes	☐Yes	☐Yes	☐Yes	☐Yes	Facial Complexion
Facial Feature	e.g. Beard/Moustache/Mole	☐Yes	☐Yes	☐Yes	☐Yes	☐Yes	Facial Feature
Individual Objects	Practice / Target 1 / Target 2 / Target 3 / Target 4	____	____	____	____	____	Individual Objects
	Cup / Book / Headphone / Headphone / Glasses	☐Yes	☐Yes	☐Yes	☐Yes	☐Yes	
	Watch / Metal bottle / Scissors / Glasses / Bag	☐Yes	☐Yes	☐Yes	☐Yes	☐Yes	
	Ring / Earphone / Buckle / Beer bottle / Tripod	☐Yes	☐Yes	☐Yes	☐Yes	☐Yes	
	Spoon / Hair ornament / / Knife / Watch	☐Yes	☐Yes	☐Yes	☐Yes	☐Yes	
	/ Scarf / / Watch /	☐Yes	☐Yes	☐Yes	☐Yes	☐Yes	
	/ / / Bracelet /	☐Yes	☐Yes	☐Yes	☐Yes	☐Yes	
Others							Others

What can we perceive?
Static/Dynamic
What do we need to perceive?
Physical appearance/Facial expression/Biological motion
How does lighting affect?
Luminance/Spectrum Distribution/Uniformity/Glare

Conclusions:

- The effect of lighting on reassurance is not yet clear;
- Lighting is not the only variable that matters for reassurance;
- The amount of reassurance required depends on the location; regardless of lighting some areas will still feel unsafe;
- It is expected that lighting in interaction with other factors will affect feelings of reassurance.

Conclusions:

- Comfort distance for pedestrians need to be reconsidered under street lighting condition;
- Facial recognition is not the only factor that matters for interpersonal judgments, recognitions of facial expression and intent, as well as body movement are essential;
- What visual cues we need for making interpersonal judgments can be divided into two parts: static and dynamic.